DESCRIPTION FOR THE GENERAL PUBLIC

Modern theory of gravitation, called *General Relativity Theory* was formulated hundred years ago by Albert Einstein. According to the theory, massive objects (like the Sun) curve the surrounding spacetime and this curvature bends the trajectories of other objects (like e.g. planets). Hence, *gravitation* is nothing but *spacetime curvature*. It behaves just like an elastic material: can be deformed, can also vibrate (such gravitational waves have been observed recently). The dynamics of these vibrations is governed by the so called *Einstein equations*. The predictions of the theory proved to be correct with an *astonishing accuracy*. These are, e.g., bending of light rays in the vicinity of stars, precise description of trajectories of planets and spaceships, and correct functioning of the Global Positioning System (GPS). Mathematical description of the field dynamics is, however, difficult: one has to separate the *true* vibrations of geometry from *fictitious* ones, describing merely the change of coordinate system. Einstein himself was unable to separate correctly these two phenomena and, at a certain period of his life, he concluded (erroneously) that all these vibrations are merely fictitious and there are *no* true gravitational waves. We propose a new, original description of the gravitational field dynamics, which leads to an efficient separation of its true degrees of freedom from fictitious (*gauge*) degrees of freedom. Advanced mathematical tools, involving various branches of differential geometry, functional analysis and partial differential equations, will be used. As a result of this research programme, we will obtain a substantial simplification of mathematical description of the gravitational field dynamics. Moreover, we expect to understand how to describe field energy carried by the field, which remains still a major puzzle of the theory.